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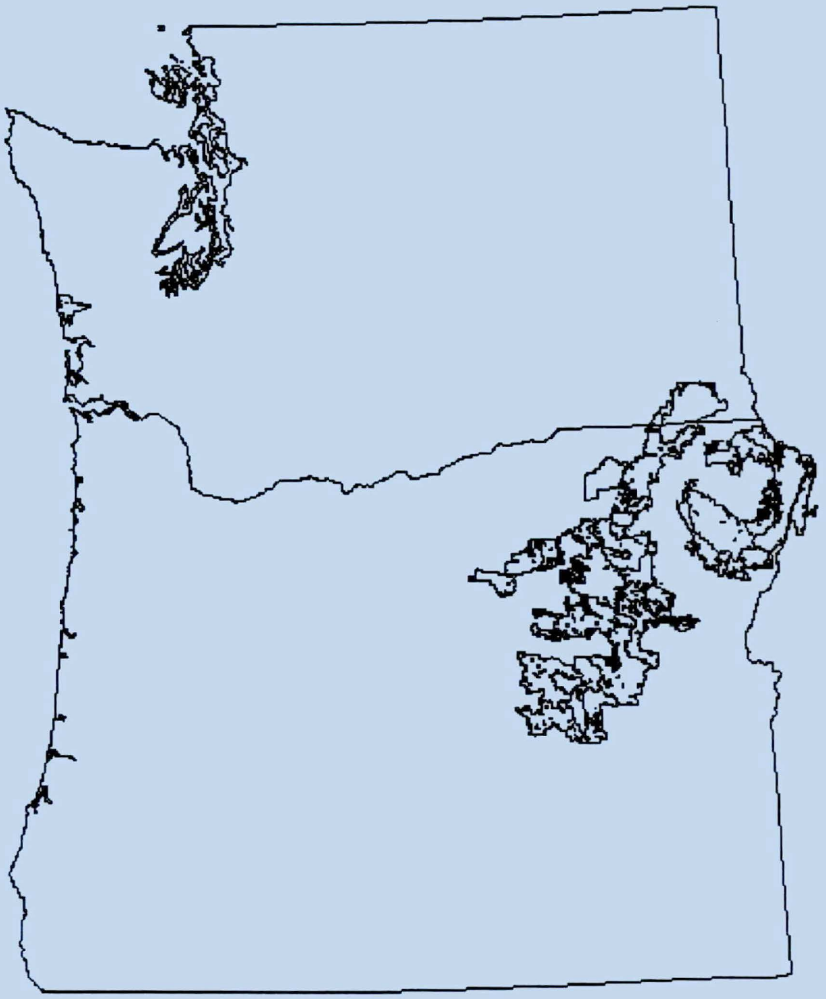
Insect and Disease Review of the Baker City Watershed



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BMZ-94-01

Insect and Disease Review of the Baker City Watershed

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Introduction

During the week of September 27 - 30, 1993, we visited the Baker Ranger District at the request of Bruce Countryman. The purpose of our visit was to review stands within the Baker City Watershed to determine current insect and disease conditions and affects, estimate impacts of insects and diseases on various resource values within the Watershed, and to describe pest management implications of various management options in regard to future condition on the Watershed.

Our review was conducted as a "walk-through" evaluation of portions of the Watershed. In addition, we drove through other parts of the Watershed that were accessible by roads to get an overview of as much of the insect and disease conditions and affects within the Watershed as possible. Some of these other areas were also reconnoitered to gather more site-specific information and to conduct site and stand ratings on the degree of imminence of current condition in relation to catastrophic levels of damage from insects and diseases.

Bruce Countryman, Stacia Peterson, and Barry Hansen of the Baker District, and Jim Caudill of the Forest Supervisor's Office accompanied us on the September 28, 1993 field evaluation visit to the area. During other days, we reconnoitered the area ourselves or with Bruce.

Site and Stand Description

A variety of site and stand conditions exist within the Watershed given the large area and differing topography and site factors. Responding to different sites, there is a spectrum of diversity of representative plant communities over the area Hence, we can describe the area only in general terms.

In this report, we make reference to specific types of stands where appropriate and helpful in facilitating discussions of insect and disease conditions. A more complete description of the stands and associated properties will likely be given in the Draft and Final Environmental Impact Statements for the Watershed. A range of site conditions, plant associations, and successional stages exist on the Watershed. These vary from dry, widely-spaced ponderosa pine/mountain-mahogany/Idaho fescue-bluebunch wheatgrass communities on south slopes to wet grand fir-dominated communities on cooler north slopes, and lodgepole pine/subalpine fir/Engelmann spruce

communities at the higher elevation, coolest sites.

Management within the Watershed has largely been limited to selective harvesting of primarily ponderosa pine, larch and Douglas-fir in some of the more accessible areas. Most roaded parcels are in the lower elevation reaches of the area. Harvesting can be characterized as being rather light; compared to similar forested communities on the Forest. For the most part, timber removal has played a secondary role to fire exclusion with regard to community successional changes from natural conditions. Unroaded portions of the area, especially the higher elevation reaches, have had no timber harvest. Little difference in stand conditions were apparent between these lightly-entered stands and unentered areas.

In many of the stands that are of greatest concern with regard to current or imminent insect and disease activity, we found successional stages and species mixes for plant associations that indicate considerable change from historic conditions; largely the result of decades of fire exclusion. These areas have typically proceeded toward climax succession and are now dominated by shade-tolerant species. What once were stands historically maintained in early seral condition by periodic surface fires as mostly ponderosa pine and western larch, are now dominated by grand fir and Douglas-fir. Seral species are not affectively regenerating because of the excessive stocking of shade tolerant firs in the understory and the lack of natural disturbance (fire). Such current conditions probably never developed in the natural system of Blue Mountain plant succession. Thus, they have deviated from normal levels of species mix and stocking levels and are well outside their natural range of variability. These stands now are highly susceptible to insect and disease infestations which contribute to the very high levels of mortality and poor level of resiliency. They are also susceptible to catastrophic, stand-replacing wildfires due to the heavy accumulation of fuels (e.g., mortality and dense fir understory) and development of fuel ladders (e.g., large Douglas-fir dwarf mistletoe brooms near the ground).

Discussion of Insect and Disease Conditions

Conditions have become ripe for defoliator outbreaks in the mixed conifer stands that have changed from seral species domination to shade-tolerant true fir-dominated successional stages in the Watershed. Shifts in conifer species composition, vertical structure/canopy layering, and stocking levels from historic conditions have become the norm for most Watershed stands. As a result of these changes, stands have developed into favored habitat for such defoliators as Douglas-fir tussock moth, *Orgyia pseudotsugata*, and western spruce budworm, *Choristoneura occidentalis*, and for outbreaks of various bark beetles that often follow defoliator outbreaks.

A variety of stand changes have increased their susceptibility to defoliating insects. From various dendrochronological and other studies of fire history and defoliator outbreaks in the Blue Mountains and elsewhere (see Agee 1993; Anderson et. al. 1987; Carlson and Wulf 1989; Gast et. al. 1991; Schmidt 1985; Swetnam and Lynch 1989; Wickman 1992; and Wulf and Cates 1987), we now know that fire exclusion and suppression practices over the last 70-80 years mostly have been responsible for these changes in forest succession. In addition, harvesting practices that favored removal of pines and larches over shade-tolerant, climax species reduced available seral seed sources and helped promote the successional changes that have occurred in our forests during this century.

Prior to European human influence in the forests of the Blue Mountains, surface fires occurred on a periodic basis of 7- to 15- or 20-year intervals. Some fires were intentially set by native Americans to improve conditions for hunting and food-gathering in the forests. Most others, though, were from natural lightning-caused ignitions. The results of these fires were typically the killing of the younger, thin-barked, shallow-rooted true fir species that had invaded the understorys of pine and larch stands, or mixtures of pine, larch, and Douglas-fir. Normally, these are the drier sites--south, southeast, and southwest aspects. Because of their thin bark and shallow root systems, true firs are more sensitive to cambial tissue damage from fire than are other conifer species that grow

in association with true firs in the Blue Mountains. Hence, fire selects against shade-tolerant, fire-sensitive species.

Unlike ponderosa pine and western larch which require exposed mineral soil and substantial light for germination and growth, true fir species can readily regenerate in undisturbed duff as well as having a high degree of shade-tolerance. That is, they can easily reproduce and grow under a shade-producing overstory tree canopy. This gives rise to multiple generations of trees from natural seed crops of nearby reproductively mature true firs. These multiple generations soon lead to nearly continuous canopy levels and to overstocked conditions for the site.

Continuous-canopy, all-aged mixed conifer stands provide highly-favorable habitat for defoliators. Larval stages of budworm and tussock moth feed primarily on true firs and Douglas-firs throughout their ranges. Dispersal in the early larval stages occurs when larvae spin down on fine silken threads and either drop onto lower foliated branches to feed, or are transported horizontally to adjacent trees by wind currents. Trees in the lower canopy levels tend to have more feeding and resultant impact.

Overstocked, multiple-canopy stands thus insures survival of the budworms and tussock moths, and favors rapid growth and development of larvae by providing abundant, high-quality food sources, and protection from natural enemies. Moreover, trees are less vigorous when growing in high competition with one another in overstocked stands. This often leads to moisture stress in true firs growing on drier pine habitats, especially during drought periods. These trees also undergo decreased carbohydrate production since trees allocate their photosynthates (i.e., energy in the form of carbohydrates) in accordance with an endogenous system of priorities. Reduced diameter growth and changes in quality and quantity of defensive chemicals to protect trees from insects and diseases are results of these prioritized plant resource allocations during periods of high stress. Leader growth and seed and cone production, for example, receive a higher priority for carbohydrate resources than radial growth and production of defensive chemicals during periods of water stress (Waring 1982). Some believe that these factors influence food quality for defoliators (cf. Cates et. al. 1983; Clancy et. al. 1988; Redak and Cates 1984). Thus, these changes translate into increased vulnerability to damage by insect herbivores. Higher food quality for defoliators enables these insects to grow rapidly and maintain great reproductive success. Under these conditions, defoliator populations express rapid rates of increase from generation to generation, and quickly shift from innocuous endemics, to serious epidemics.

The Baker City Watershed has had minimal silvicultural activity over the years due to the need to minimize ground-disturbing activities and maintain water quality at high levels for Baker City municipal use. Consequently, many stands have evolved into conditions similar to that described in previous paragraphs.

Our observations of areas such as within the Elk Creek drainage, and along the "pipeline" road, indicate most stands have widespread heavy defoliation--many ranging in the 80-100% defoliation categories--and mortality to the grand fir and Douglas-fir components, especially in the intermediate and suppressed tree classes. Some larger trees also were dying from a variety of conditions. Many of these stands have a reasonably healthy ponderosa pine component but they are still seriously overstocked; larch seems to be declining in the overstory and not becoming established in the understory in most of the stands we looked at. Fortunately, budworm populations began to decline last year. The decline has continued this year and trees are beginning to recover from the effects of defoliation and drought. Still, budworms have left their indelible mark on the landscape--there is a large amount of tree mortality in the wake of the outbreak, and many other trees have been top-killed and will form multiple tops and may eventually develop differing degrees of top-decay in the years to come (Aho 1984).

Stands with high mortality of grand fir and Douglas-fir: (1) provide poor quality habitat for big game animals;

(2) provide poorer substrate to intercept precipitation in the form of snow, rain, and dew which aids in preventing runoff and erosion damage by lessening impaction and flushing of soils; (3) retain and filter less moisture in the form of precipitation, and provide less evapotranspirative loss due to loss of needle surface area than foliated trees; (4) prevent full utilization of sites by taking up productive spaces that could be growing healthy trees and vegetation; and (5) pose great risk of catastrophic wildfire. This last point is probably the most critical to the principal management objective for the area: to provide a continuous source of water, maintaining both high flow rates and high-quality for Baker City municipal use.

In addition to budworm-caused defoliation, top-kill, and tree mortality in smaller trees, we also observed secondary mortality of the drought-weakened and defoliated sawlog-sized trees from bark beetles and woodborers. Extremely high levels of dwarf mistletoes are causing tree and stand damage at par to insect-caused damage. Coupled with recent drought-related stress, bark beetles are finishing off weakened trees. Increases in bark beetle populations characterize the normal pattern of insect succession following defoliator outbreaks, drought, or combinations of both.

Populations of fir engravers, *Scolytus ventralis*, in grand fir, and Douglas-fir beetles, *Dendroctonus pseudotsugae*, in Douglas-fir, have increased over the Watershed the past several years. Although we believe populations of these bark beetles have peaked and are now declining, some new beetle attacks can still be found in stands. Overall, our observations suggest--and related research studies bear this out--that pole-size and sawlog-size tree species susceptible to fir engraver and Douglas-fir beetles, that are 50-percent or greater defoliated, rarely die from defoliation alone but are often killed by these secondary bark beetles. This mortality usually begins showing up within three years of the time of heaviest defoliation of trees and may continue for several years beyond that if severe outbreaks occur and beetles begin attacking otherwise healthy green trees. It is more common for Douglas-fir beetles to develop to outbreaks in this manner than for fir engravers.

Increases in the level of Douglas-fir dwarf mistletoe *Arceuthobium douglasii*, both on individual trees and on a stand basis, as Douglas-fir stocking in the understory has dramatically increased in the last few decades in Watershed stands with a substantial Douglas-fir component. The increase in brooming is predisposing affected stands to conflagration fires and the decrease in tree vigor is resulting in primary and secondary mortality. Douglas-fir beetles and some woodborers have contributed to Douglas-fir mortality as host resistance is at a low ebb from other insect feeding, drought stress, and dwarf mistletoe. Of considerable concern is the lost viability of the understory since mistletoe-infected Douglas-fir are not able to affectively respond to release nor develop into an overstory component. Within 15 years following spacing or release, once healthy-looking Douglas-fir with latent mistletoe infections (from overstory sources) no longer effectively grow. These trees "broom-up"; they're also the first to crown-out in fires. These latent infections are almost always underestimated in the field since infected trees in fully-stocked stands do not readily develop many brooms. Following stand spacing or overstory removal, these infections release and quickly overwhelm the tree.

Western larch dwarf mistletoe *A. laricis,* is also common in the Watershed. This disease readily kills large overstory larch after years of heavy infestation. While this mistletoe has always been a major influence in larch communities in the Blue Mountains, lack of natural disturbances have greatly reduced the development of larch understory, and overstory larch are succumbing without larch filling in behind in the understory. As a net result, seed sources and total larch stocking are declining with time.

There has been some research on relationships of dwarf mistletoes and fire. Most work has been done with pines. Most of the findings are also applicable to Douglas-fir infected with *A. douglasii.* Fire affects on dwarf mistletoes are mostly indirect. Flames, heat and smoke seem to have no selective action on the mistletoe plant or infection over the host (Wicker and Leaphart 1975). However, fire does play a very significant role in maintaining low levels of infestation in infected stands, and infestations increase with the absence of fire. These

roles are summarized as follows:

1. Infected trees are more apt to be killed by fires. Heavily-infected Douglas-fir often have large dense brooms that are close to the ground. These brooms do not self-prune as well as uninfected branches. Brooms serve as fuel ladders to the upper portion of the crown (often where more booms occur). Brooms are more flammable than normal foliage; catching and retaining dead needles and other debris. On heavily infected trees, some brooms are often dead; thus being extremely flammable in dry conditions. Both mistletoe-infected Douglas-fir and western larch accumulate dead brooms around their base. During fires, this excess fuel may produce a lethal level of heat, or it may increase the flame length such that the fire crowns out on that tree.

2. Dwarf mistletoe-infected trees are more apt to be killed following fires. Since trees are increasingly weakened by mistletoe infection severity, trees that may survive the direct effects of fire may succumb in the following few years as secondary insects (especially bark beetles) and diseases attack trees in their post-fire weakened state, and vigor of these mistletoe-infected survivors is especially low.

3. In the Douglas-fir series communities normally held in an early sere pine dominance by fire, dwarf mistletoe incidence and severity greatly increases with it's host abundance. Dwarf mistletoes are most effective at building to very high levels in those stands dominated by susceptible hosts. Additionally, infestations in the overstory are very quickly spread to a susceptible understory. Douglas-fir series communities, typified by the Douglas-fir/ninebark community, frequently have very high levels of mistletoe and associated mortality. Such stands are normally frequently visited by fire which keeps pine stocking high and reduces the level of Douglas-fir in the understory. Without fire, Douglas-fir stocking predominates in the understory, becoming heavily infected from the infected overstory trees.

4. Fire plays a major role in the distribution of dwarf mistletoes. In drainages recently having had a major stand-replacement fire, dwarf mistletoes are frequently absent or localized around the few surviving infected host remnants. Hot conflagration fires often leave no survivors, even larch and Douglas-fir, normally fire-resistant species. Given decades or centuries, mistletoes will eventually migrate back in, usually with the help of birds inadvertently carrying seeds on their bodies.

Fire and dwarf mistletoes have co-existed for eons. It does however seem that removal of fire from the system allows conditions to change such that ground fire is no longer able to rejuvenate stands that have become severely infected without creating a wholesale conflagration stand-replacement fire event.

During our review of stands on the Watershed, we observed a few mature ponderosa pine that had been killed by mountain pine beetles, *D. ponderosae*. This is a little bit unusual in that usually these large, old trees are killed by western pine beetles, *D. brevicomis*. However, it is not totally unexpected that mountain pine beetles killed these trees. We are moving into a period of increasing mountain pine beetle populations throughout the Blue Mountains. Indeed, rapidly increasing populations over the past several years have led to an epidemic of beetles just to the south of the Watershed, in the Lower Montane area on the District. Beetles are spreading from the infested second-growth ponderosa pine stands to nearby areas, including the Watershed. There may be other old-growth pines that succumb to these beetles, but we would expect the worst mortality to be in those younger stands that have grown into stages of higher susceptibility (e.g., stands with average age 50-100 years; average diameters of 8 inches or more; stocking levels of 150 square feet of basal area or more per acre; and radial growth at less than one-inch per decade).

Drought is a predisposer of old, slow-growing ponderosa pines to bark beetles. Even though 1993 had a wet

spring, this welcomed precipitation was not enough to reverse the drought-stress that have weakened trees over the last six or seven years. We are just now beginning to see the consequences of drought stress on the ponderosa pines. It has taken a little longer for the drought to weaken these drought-tolerable pines. So many hundreds, or thousands, of continuous acres were already primed for an outbreak because of competition and overcrowding, that it didn't require much additional stress to "tip the scales" in favor of the insect. Once large populations build up in weakened host trees, beetles begin switching to healthier green trees, and the outbreak gets into full swing. We can expect to see these bark beetles continuing to increase numbers and become an even greater hinderance to meeting resource management objectives in the future unless stands are soon brought under management by controlling stand density in overstocked stands.

Impacts of Insects and Diseases on Resource Values

We used a rating system ("Stand Classification to Determine Imminence of Catastrophic Damage," see Schmitt and Scott 1993) to document the relative degree of stand damage from a variety of agents to eight representative mixed conifer stands on the Watershed. The rating took into account several important factors including: (1) Relative status of Forest Plan Desired Future Condition for management area or resource; (2) Proportion of major species basal area currently defective or dead, or will be within the next 10 years; (3) Current stocking conditions, including all live tree species; (4) Relative fuels condition (i.e., size, accumulation, and structure) and potential for catastrophic stand replacement fire before the next planned management entry; (5) Relative risk of spread of insects or diseases from infested or infected overstory stand components to susceptible developing or advanced regeneration; and (6) Relative risk of losing present silvicultural options in stands, based on insect and disease effects, stand structure, and composition. This information also helped to determine impact of insects and diseases on various resources. These ratings are included with a brief stand description in the **Appendix.**

In almost every case of rating stands, we determined composite scores that clearly placed them at a current level of catastrophic damage. In cases where catastrophic damage from insects and diseases had been reached, the desired future condition of a number of resource values and other concerns were compromised either in the short-term or long-term, or in both. Hence, we would expect to see manifestation of any number of possible symptoms or effects on resources, including, but not limited to these: (1) Diminished wildlife habitat quality and usage (e.g., reduced cover for thermoregulation of elk, hiding and escapement, and inadequate wildlife travel corridors); (2) Increased erosion of soils; (3) Increased surface water runoff and flowing water sedimentation/turbidity; (4) Increased fire potential; (5) Reduced visual quality from Baker Valley and residential areas on the lower slopes of the Elkhorn Mountains; (6) Underutilization of productive sites (i.e., understocked or non-stocked sites); (7) Increased road maintenance costs due to erosion (e.g., "pipeline" road and primary access spur roads); (8) Above-ground/below-ground nutrient ratios that are outside the range of natural variability. These ratios have an effect on the sustainability of forest productivity and certain ecosystem processes, particularly those of the soil microenvironment (e.g., fires in the heavy fuel accumulations could volatilize nutrients such as nitrogen, phosphorus, and sulfur, resulting in a net nutrient loss to the forest soils, and impairing long-term productivity); (9) Air quality could be temporarily, adversely impacted in the event of fire in stands with heavy tree mortality from a variety of insects and diseases; and (10) In the event of fire, forest soils could be seriously damaged or impaired if fire intensity was high, and fire was sustained for long durations in stands because of particularly heavy tree mortality and fuel conditions.

Pest Management Implications of Management Options

Finally, we would like to address the pest management implications of various management options that may or may not be considered for the Baker City Municipal Watershed by the Forest Service.

Fuel Reduction

The forest fuels situation is of immediate and highest concern in the Watershed. We share the District's and City's concern about the high potential fire hazard of the fuels situation in the Watershed. Heavy fuel accumulations and fuel ladder conditions have developed over decades of fire exclusion and mistletoe infestation in the Watershed, and from the more recent creation of high levels of tree mortality from insect and disease outbreaks during the past 10 to 15 years. There is a high probability that significant damage to the Watershed and the quality of the water supplied to Baker City could result from ignition of fuels and a landscape-scale fire in the Watershed. We believe that the accumulations of dead and dying trees, and the fuel laddering of multistoried stands, pose significant risk of carrying a fire of catastrophic proportions through the Watershed. Moreover, we believe that this type of fire potential could also result in considerable losses to some of the stands of mature and overmature seral species that normally survive surface fires because of their thick, fire-resistant bark protecting the cambium. Under current conditions of fuels on the Watershed, ground fires could quickly become crown fires.

In essence, fuels reduction should have as its objective, not only the lowering of fire risk, but also lowering the risk of potential undesirable levels of insect- and disease-caused damage to stands by facilitating the regeneration of tree species that are less susceptible to fire, insects, and diseases.

There is a clear need to reduce forest fuels throughout most of this area, either by disposal on site, or by direct removal through salvage and capture of mortality. This action, we believe, is necessary to not only reduce forest fuels and reduce the risk of catastrophic wildfire, but to also free up productive ground to encourage the regeneration of seral species on the site.

Stand Rehabilitation

From a self-sustaining ecosystem perspective, seral species will have fewer problems in the future that might lead to undesirable levels of tree mortality and resource damage from insects and diseases. Also, seral species are better adapted to many of the sites now stocked with shade-tolerant climax species. Seral species regeneration and establishment should be encouraged wherever possible to help return stands to their natural range of variability. Outbreaks of insects and diseases, such as have occurred on the Watershed, are two of nature's most potent ways of re-establishing seral species dominance on sites that have progressed successionally beyond what would have resulted if nature were left to pursue its own course. We suggest that our management activities within the watershed seek to mimic the natural ecosystem processes as much as possible within the bounds of Forest Plan resource management and ecosystem objectives.

Where reestablishment of seral dominance is decided management direction, we suggest that striving for a mix of ponderosa pine, western larch, and Douglas-fir would be best to avoid excessive insect- and disease-caused mortality in the future, and to help maintain species diversity. However, composition of budworm and tussock moth susceptible species in stands (i.e., Douglas-fir and grand fir) should not exceed 30 percent of the species stocking the sites (Carlson and Wulf 1989). The susceptibility and vulnerability to damage by defoliators in mixed conifer stands varies in direct proportion to the insect host density stocking in a stand. Limiting the proportion of climax species in the stand to less than 30 percent will make these stands much less susceptible to defoliators in the future. Maintenance of seral dominance will require cultural activity and/or periodic use of ground fire to remove excess grand fir and Douglas-fir regeneration.

Fuel Breaks

In another aspect of fire management regarding the Watershed, we concur with the need to provide fuel breaks to

slow the movement of fire, should one start. A consideration of using shaded fuel breaks as a means to help moderate the scope and effects of wildfire on the landscape is an approach that not only accomplishes fire management objectives, but also pest management objectives, while moderating the impacts on the ecosystem.

The benefits of improved tree vigor and health; hence, resistance to insects and diseases, will be derived to the degree that stocking is reduced within the fuel break, and to the degree that shade-tolerant climax species are removed in favor of leaving seral pines and larches, as well as some Douglas-firs. Once again, a basic pest management principle is to favor whenever possible, the least insect- and disease-susceptible species and discriminate against those species that have higher risk of being damaged by insects and diseases. The principle is based upon the natural selective processes by which biotic agents operate in stands, if allowed the opportunity. Studies have shown that thinning, for example, will increase stand vigor, increase budworm larval mortality by increasing dispersal losses between trees, and further reduce the amount of budworm host tree species or habitat (Carlson et. al. 1985; Carlson and Wulf 1989). Insects, diseases, and fire are nature's principal thinning agents.

Stands adjacent to, and potentially protected by shaded fuel breaks, may be some of those stands in which fuels reduction work will additionally occur. To meet the balanced needs of resources, and maintain a vital and fully-functioning ecosystem, we suggest that a certain amount of the insect- and disease-caused tree mortality is beneficial to the ecosystem as a whole. The dead trees provide wildlife habitat in the form of snags for cavity-nesting birds, or perches for raptor species. Both carpenter ants, *Camponotus* spp., and mound-building or thatch-ants, *Formica* spp., commonly utilize these dead woody structures as nest sites, as well as the large woody debris component that topples to the ground and deteriorates. The ants, in turn, provide not only a source of biological regulation of defoliators by preying on budworm and tussock moth larvae and helping to maintain low density populations of these insects (Campbell and Torgersen 1982; Torgersen and Dahlsten 1978), but also provide food for a number of bird species (Fischer and McClelland 1983; Scott et. al. 1977), notably, pileated woodpeckers, *Dryocopus pileatus*, (Beckwith and Bull 1985; Bull, et. al. 1992).

Reducing Bark Beetle Hazards

We have a special concern about the bark beetle outbreak potential of the overstocked ponderosa pine stands within, and adjacent to the Watershed. The following paragraphs should clarify our concerns.

Bark beetles play a major role in the dynamics and ecology of ponderosa pine stands in the Blue Mountains, and regionally. The role of fire in Blue Mountains forested ecosystems is now widely known from many observations, studies, and reports. And, like fire, insects, too, play an important natural role in regulating species composition and stocking levels. Their presence and role have not been fully defined nor appreciated from an ecosystem perspective. Exclusion of fire has allowed species composition shifts toward climax types in some stands, and has led to overstocking in nearly all stands where fires were not allowed to burn under conditions of natural ignition.

We have effectively managed to keep fire from influencing stand conditions over most of the present century, or at least limited fire's natural occurrence and role in the ecosystem. As an agency, we have not been as successful at limiting insect activity because we have not aggressively thinned overstocked stands and promoted the establishment and maintenance of seral tree species--one major historic role of fire in Blue Mountains ecosystems.

Without fire, insects and diseases--particularly insects--have become the dominant force in maintaining stands in seral condition, or in pushing stands back to earlier seral stages.

Under the right conditions, bark beetles can breed large populations in susceptible host stands and dramatically

alter: (1) tree stocking levels; (2) habitat for various animals--negatively for some, and positively for certain others; (3) species compositions; (4) age and size classes; and (5) future wood-volume of the stand, where appropriate. Outbreak areas dramatically increase in size because aggressive beetles switch attacks from weakened, susceptible trees to healthy, green trees. Tree mortality typically range far outside the range of natural variability for insect-caused mortality, compared to the time when fire was the primary agent of natural thinning and regulation of stand density in the Blue Mountains pine communities.

Both fire and insects encourage early- to mid-seral stages of succession. In the mixed conifer stands, both agents select against shade-tolerant climax species, leaving the seral species to regenerate the site. In the predominant pine community types, fire selects against small diameter trees leaving the more fire-resistant veterans to regenerate the site. Historically, these stands took on the appearance of open, park-like savannahs, and contained very few--but large diameter--trees, and tall grasses covering the ground beneath. Bark beetles, on the other hand, typically attack and kill the larger diameter trees first leaving smaller diameter trees to provide seed for regeneration as they obtain reproductive age. In either case, the stand is opened, and changes in light and temperature regimes encourage the germination, establishment, and growth of seral tree species.

The increasing mountain pine beetle activity in proximity to the Watershed is beginning to exert an influence on the overstocked stands of the Watershed. Bark beetle pockets are showing up in nearly all of these type of stands where stocking levels are near or above the 150 square feet of basal area per acre threshold we use to indicate high beetle hazard. One of the stands we looked at near Washington Gulch contained stocking levels ranging from 100-140 square feet per acre, and radial growth ranged between 8-15 20ths of an inch per decade. The stand contained recent pockets of mountain pine beetle-caused mortality. Research has shown that pine stands become increasingly more susceptible to these bark beetles when tree growth slows to less than 20-twentieths of an inch per decade (Hall 1987). Reduction of bark beetle risk can easily be achieved by stocking level control accomplished through a program of thinning trees, and spacing them to reduce competition for sunlight and growing space. In most cases, this involves reducing basal areas to around 70 or 80 square feet per acre, and spacing trees on an 18 x 18-foot or wider spacing. Risk may be lowered to "low" for as much as 2 or 2 1/2 decades under this scenario. This level would provide for adequate levels of tree mortality over time to help meet ecosystem needs for stand diversity, snag recruitment for wildlife habitat, and to provide a woody debris component to enhance nutrient cycling processes and sustainability of long-term site productivity.

The consequences of not thinning overstocked ponderosa pine stands soon could be such high levels of tree mortality in the greatest overstocked stands, that few resources would benefit from the outcome, and the net affects of such a situation would be negative. For example, some studies have shown that bark beetle outbreaks that start in pine stands that are highly overstocked kill as much as 40-60 percent of the basal area (Sartwell 1972). Other studies have shown that 60 percent of the trees, representing 80 percent of the total stand volume can be killed by mountain pine beetle in overstocked stands (Pitman et. al. 1982).

Clearly, tree mortalities of this order far exceed the reasonable needs for wildlife, diversity, nutrient cycling, site productivity, and other resources. The potential impacts to the Watershed, as indicated earlier, should be a primary consideration as the district develops alternatives regarding the needs, locations, and magnitude of stocking level controls to undertake within, or adjacent to the Watershed, as well as the various other possible actions related to forest fuels reduction and fire management that may be considered.

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Appendix

STAND RATING SYSTEM FOR THE BLUE MOUNTAINS
STAND CLASSIFICATION TO DETERMINE IMMINENCE OF CATASTROPHIC DAMAGE
(NORTHEAST OREGON AND SOUTHEAST WASHINGTON)

Donald W. Scott and Craig L. Schmitt
Blue Mountains Pest Management Zone
Wallowa-Whitman National Forest

Forest/District: WAW/BAK
Planning Area: Baker City Watershed
Stand location: T9S, R38E, NE1/4,NW1/4 sec.13
Brief Stand Description: Overstory of Abgr, Laoc, Psme, (Pipo); Understory pure Abgr. Choc-caused mortality is severe in understory. However stand structure is intact and viable. Stand is young, dating from a stand replacement fire 110 years ago. Some larger Abgr have recent Scve-caused mortality. There is no Arla in the Laoc, making larch a most viable conifer for the long-term. No past harvest history.

		Score
(1)	Relative status of Forest Plan "Desired Future Condition" for management area or resource: Currently meets long-term (50 years) Desired Future Condition (value = 0) Currently meets short-term (10 years) Desired Future Condition, but will probably not meet long-term Desired Future Condition (value = 1) Currently meets neither short-term nor long-term Desired Future Condition, nor is expected to due to current pest trends and stand conditions (value = 2)	0
(2)	Proportion of major stand species basal area currently defective or dead, or will be within the next 10 years: < 25% affected (value = 0) 25-50% affected (value = 1) 51-75% affected (value = 2) 76-100% affected (value = 3)	1
(3)	Current stocking conditions (include all live tree species): Normal stocking (75-100%) (value = 0) Minimum or understocked (value = 1) Overstocked (value = 2)	0
(4)	Relative fuels condition (size, accumulation, and structure) and potential for catastrophic stand replacement fire before the next planned management entry:	2

Currently meets "normal" range of fuels condition expected for this plant association at normal stocking (value = 0)

Current range of fuels "moderate" for this plant association; potential for increase in fuels from current or expected insect, disease, or other catastrophic event also moderate (value = 1)

Current range of fuels "high" for this plant association, or expected to be high due to insect, disease, or other catastrophic events affecting stand now, or within next ten years resulting in at least a 50% probability of a major fire event (value = 2)

(5) Relative risk of spread of insects or diseases from infested or infected overstory stand components to susceptible developing or advanced regeneration: 0

Overstory infestation/infection non-existent or very "low;" risk of spread to understory components also "low" (value = 0)

Overstory infestation/infection and risk of spread to understory "moderate" (value = 1)

Overstory infestation/infection and risk of spread to understory "high" (value = 2)

(6) Relative risk of losing present silvicultural options in stands, based on insect and disease effects, stand structure, and composition: 0

Risk non-existent or low (value = 0)

Risk moderate (value = 1)

Risk high (value = 2)

STAND COMPOSITE SCORE 3

Forest/District: WAW/BAK
Planning Area: Baker City Watershed
Stand location: T9S, R38E, SW1/4, SE1/4 sec. 12
Brief Stand Description: Old stand with scattered Pipo, Laoc remnants, Abgr, and Psme. Understory is pure Abgr which has been mostly killed by Choc. Mistletoes are severe in larch and extremely severe in Psme; Choc has killed at least half of the grand fir understory and killed tops of larger trees. Fuel loads are very high.

		Score
(1)	Relative status of Forest Plan "Desired Future Condition" for management area or resource: Currently meets long-term (50 years) Desired Future Condition (value = 0) Currently meets short-term (10 years) Desired Future Condition, but will probably not meet long-term Desired Future Condition (value = 1) Currently meets neither short-term nor long-term Desired Future Condition, nor is expected to due to current pest trends and stand conditions (value = 2)	2
(2)	Proportion of major stand species basal area currently defective or dead, or will be within the next 10 years: < 25% affected (value = 0) 25-50% affected (value = 1) 51-75% affected (value = 2) 76-100% affected (value = 3)	2
(3)	Current stocking conditions (include all live tree species): Normal stocking (75-100%) (value = 0) Minimum or understocked (value = 1) Overstocked (value = 2)	2
(4)	Relative fuels condition (size, accumulation, and structure) and potential for catastrophic stand replacement fire before the next planned management entry: Currently meets "normal" range of fuels condition expected for this plant association at normal stocking (value = 0) Current range of fuels "moderate" for this plant association; potential for increase in fuels from current or expected insect, disease, or other catastrophic event also moderate (value = 1)	2

Current range of fuels "high" for this plant
association, or expected to be high due to
insect, disease, or other catastrophic events
affecting stand now, or within next ten years
resulting in at least a 50% probability of a major fire event

(value = 2)

(5) Relative risk of spread of insects or diseases from infested or infected overstory stand components to susceptible developing or advanced regeneration: 0

Overstory infestation/infection non-existent or very "low;" risk of spread to understory components also "low" (value = 0)
Overstory infestation/infection and risk of spread to understory "moderate" (value = 1)
Overstory infestation/infection and risk of spread to understory "high" (value = 2)

(6) Relative risk of losing present silvicultural options in stands, based on insect and disease effects, stand structure, and composition: 2

Risk non-existent or low (value = 0)
Risk moderate (value = 1)
Risk high (value = 2)

STAND COMPOSITE SCORE 10

Forest/District: WAW/BAK
Planning Area: Baker City Watershed
Stand location: T9S, R39E, SW1/4, SW1/4 sec. 7
Brief Stand Description: Overstory components of Pipo, Psme, Abgr, Laoc, Pico. Understory is pure Abgr which is mostly all recently killed by Choc. Pipo has had some recent Depo-caused mortality; Psme has extreme levels of mistletoe and very severe damage from budworm; Abgr is very severely damaged by both CHoc and Scve; Laoc is very severely impacted by Arla; Pico has very high levels of lodgepole pine dwarf mistletoe (*A. americanum*).

Score

(1) Relative status of Forest Plan "Desired Future Condition" for management area or resource: **2**

- Currently meets long-term (50 years) Desired Future Condition (value = 0)
- Currently meets short-term (10 years) Desired Future Condition, but will probably not meet long-term Desired Future Condition (value = 1)
- Currently meets neither short-term nor long-term Desired Future Condition, nor is expected to due to current pest trends and stand conditions (value = 2)

(2) Proportion of major stand species basal area currently defective or dead, or will be within the next 10 years: **3**

- < 25% affected (value = 0)
- 25-50% affected (value = 1)
- 51-75% affected (value = 2)
- 76-100% affected (value = 3)

(3) Current stocking conditions (include all live tree species): **1**

- Normal stocking (75-100%) (value = 0)
- Minimum or understocked (value = 1)
- Overstocked (value = 2)

(4) Relative fuels condition (size, accumulation, and structure) and potential for catastrophic stand replacement fire before the next planned management entry: **2**

- Currently meets "normal" range of fuels condition expected for this plant association at normal stocking (value = 0)
- Current range of fuels "moderate" for this plant association; potential for increase in fuels from current or expected insect, disease, or other catastrophic event also moderate (value = 1)

Current range of fuels "high" for this plant association, or expected to be high due to insect, disease, or other catastrophic events affecting stand now, or within next ten years resulting in at least a 50% probability of a major fire event

(value = 2)

(5) Relative risk of spread of insects or diseases from infested or infected overstory stand components to susceptible developing or advanced regeneration: 0

Overstory infestation/infection non-existent or very "low;" risk of spread to understory components also "low" (value = 0)
Overstory infestation/infection and risk of spread to understory "moderate" (value = 1)
Overstory infestation/infection and risk of spread to understory "high" (value = 2)

(6) Relative risk of losing present silvicultural options in stands, based on insect and disease effects, stand structure, and composition: 2

Risk non-existent or low (value = 0)
Risk moderate (value = 1)
Risk high (value = 2)

STAND COMPOSITE SCORE 10

Forest/District: WAW/BAK
Planning Area: Baker City Watershed
Stand location: T9S, R38E, NE1/4 SE1/4 sec.13
Brief Stand Description: A Psme/Phmy plant community; Overstory of Psme, Pipo, and Laoc. Understory of mostly Psme and a few Abgr. Psme is mostly dead by Ardo--extremely severe infestation; Pipo is quite viable!; Laoc has a minor level of Arla. Most of the Psme understory is dead from Ardo and Choc. Fuel leads are very high and a fire would kill Pipo seed trees.

Score

(1) Relative status of Forest Plan "Desired Future Condition" for management area or resource: **2**

- Currently meets long-term (50 years) Desired Future Condition (value = 0)
- Currently meets short-term (10 years) Desired Future Condition, but will probably not meet long-term Desired Future Condition (value = 1)
- Currently meets neither short-term nor long-term Desired Future Condition, nor is expected to due to current pest trends and stand conditions (value = 2)

(2) Proportion of major stand species basal area currently defective or dead, or will be within the next 10 years: **3**

- < 25% affected (value = 0)
- 25-50% affected (value = 1)
- 51-75% affected (value = 2)
- 76-100% affected (value = 3)

(3) Current stocking conditions (include all live tree species): **1**

- Normal stocking (75-100%) (value = 0)
- Minimum or understocked (value = 1)
- Overstocked (value = 2)

(4) Relative fuels condition (size, accumulation, and structure) and potential for catastrophic stand replacement fire before the next planned management entry: **2**

- Currently meets "normal" range of fuels condition expected for this plant association at normal stocking (value = 0)
- Current range of fuels "moderate" for this plant association; potential for increase in fuels from current or expected insect, disease, or other catastrophic event also moderate (value = 1)

Current range of fuels "high" for this plant association, or expected to be high due to insect, disease, or other catastrophic events affecting stand now, or within next ten years resulting in at least a 50% probability of a major fire event

(value = 2)

(5) Relative risk of spread of insects or diseases from infested or infected overstory stand components to susceptible developing or advanced regeneration: 0

Overstory infestation/infection non-existent or very "low;" risk of spread to understory components also "low" (value = 0)
Overstory infestation/infection and risk of spread to understory "moderate" (value = 1)
Overstory infestation/infection and risk of spread to understory "high" (value = 2)

(6) Relative risk of losing present silvicultural options in stands, based on insect and disease effects, stand structure, and composition: 2

Risk non-existent or low (value = 0)
Risk moderate (value = 1)
Risk high (value = 2)

STAND COMPOSITE SCORE 10

Forest/District: WAW/BAK
Planning Area: Baker City Watershed
Stand location: T9S, R38E, NE1/4, NE1/4 sec. 24
Brief Stand Description: Overstory is mainly Psme, Abgr, and Laoc. Most Psme have been killed by Ardo and Deps. There is excessive levels of Choc damage. Larch is not infected with Arla and is viable. Fuels are excessive and they pose a risk to larch seed trees.

Score

(1) Relative status of Forest Plan "Desired Future Condition" for management area or resource: **2**

- Currently meets long-term (50 years) Desired Future Condition (value = 0)
- Currently meets short-term (10 years) Desired Future Condition, but will probably not meet long-term Desired Future Condition (value = 1)
- Currently meets neither short-term nor long-term Desired Future Condition, nor is expected to due to current pest trends and stand conditions (value = 2)

(2) Proportion of major stand species basal area currently defective or dead, or will be within the next 10 years: **3**

- < 25% affected (value = 0)
- 25-50% affected (value = 1)
- 51-75% affected (value = 2)
- 76-100% affected (value = 3)

(3) Current stocking conditions (include all live tree species): **1**

- Normal stocking (75-100%) (value = 0)
- Minimum or understocked (value = 1)
- Overstocked (value = 2)

(4) Relative fuels condition (size, accumulation, and structure) and potential for catastrophic stand replacement fire before the next planned management entry: **2**

- Currently meets "normal" range of fuels condition expected for this plant association at normal stocking (value = 0)
- Current range of fuels "moderate" for this plant association; potential for increase in fuels from current or expected insect, disease, or other catastrophic event also moderate (value = 1)

Current range of fuels "high" for this plant association, or expected to be high due to insect, disease, or other catastrophic events affecting stand now, or within next ten years resulting in at least a 50% probability of a major fire event

(value = 2)

(5) Relative risk of spread of insects or diseases from infested or infected overstory stand components to susceptible developing or advanced regeneration: 0

Overstory infestation/infection non-existent or very "low;" risk of spread to understory components also "low" (value = 0)
Overstory infestation/infection and risk of spread to understory "moderate" (value = 1)
Overstory infestation/infection and risk of spread to understory "high" (value = 2)

(6) Relative risk of losing present silvicultural options in stands, based on insect and disease effects, stand structure, and composition: 2

Risk non-existent or low (value = 0)
Risk moderate (value = 1)
Risk high (value = 2)

STAND COMPOSITE SCORE 10

Forest/District: WAW/BAK
Planning Area: Baker City Watershed
Stand location: T9S, R39E, SW1/4, SW1/4 sec. 18
Brief Stand Description: Overstory is Psme, Pipo, and Laoc. Psme is 95% infected with Ardo-most are already dead, rest soon to follow. Pipo has minor Depo activity; Laoc has minor Arla infections. Fuel loads are off the scale!

Score

(1) Relative status of Forest Plan "Desired Future Condition" for management area or resource: **2**

- Currently meets long-term (50 years) Desired Future Condition (value = 0)
- Currently meets short-term (10 years) Desired Future Condition, but will probably not meet long-term Desired Future Condition (value = 1)
- Currently meets neither short-term nor long-term Desired Future Condition, nor is expected to due to current pest trends and stand conditions (value = 2)

(2) Proportion of major stand species basal area currently defective or dead, or will be within the next 10 years: **2**

- < 25% affected (value = 0)
- 25-50% affected (value = 1)
- 51-75% affected (value = 2)
- 76-100% affected (value = 3)

(3) Current stocking conditions (include all live tree species): **1**

- Normal stocking (75-100%) (value = 0)
- Minimum or understocked (value = 1)
- Overstocked (value = 2)

(4) Relative fuels condition (size, accumulation, and structure) and potential for catastrophic stand replacement fire before the next planned management entry: **2**

- Currently meets "normal" range of fuels condition expected for this plant association at normal stocking (value = 0)
- Current range of fuels "moderate" for this plant association; potential for increase in fuels from current or expected insect, disease, or other catastrophic event also moderate (value = 1)

Current range of fuels "high" for this plant association, or expected to be high due to insect, disease, or other catastrophic events affecting stand now, or within next ten years resulting in at least a 50% probability of a major fire event

(value = 2)

(5) Relative risk of spread of insects or diseases from infested or infected overstory stand components to susceptible developing or advanced regeneration: 0

Overstory infestation/infection non-existent or very "low;" risk of spread to understory components also "low" (value = 0)
Overstory infestation/infection and risk of spread to understory "moderate" (value = 1)
Overstory infestation/infection and risk of spread to understory "high" (value = 2)

(6) Relative risk of losing present silvicultural options in stands, based on insect and disease effects, stand structure, and composition: 2

Risk non-existent or low (value = 0)
Risk moderate (value = 1)
Risk high (value = 2)

STAND COMPOSITE SCORE 9

Forest/District: WAW/BAK
Planning Area: Baker City Watershed
Stand location: T9S, R39E, SE1/4, SE1/4 sec. 18
Brief Stand Description: Overstory is Psme, Abgr, and Pipo. The understory is Psme and Abgr. Psme is severely infected with Ardo and has had very severe levels of Choc. Abgr was noted to have damage from both Choc and Scve. Understory of both species is mostly dead from Choc and Ardo.

Score

(1) Relative status of Forest Plan "Desired Future Condition" for management area or resource: **2**

- Currently meets long-term (50 years) Desired Future Condition (value = 0)
- Currently meets short-term (10 years) Desired Future Condition, but will probably not meet long-term Desired Future Condition (value = 1)
- Currently meets neither short-term nor long-term Desired Future Condition, nor is expected to due to current pest trends and stand conditions (value = 2)

(2) Proportion of major stand species basal area currently defective or dead, or will be within the next 10 years: **1**

- < 25% affected (value = 0)
- 25-50% affected (value = 1)
- 51-75% affected (value = 2)
- 76-100% affected (value = 3)

(3) Current stocking conditions (include all live tree species): **2**

- Normal stocking (75-100%) (value = 0)
- Minimum or understocked (value = 1)
- Overstocked (value = 2)

(4) Relative fuels condition (size, accumulation, and structure) and potential for catastrophic stand replacement fire before the next planned management entry: **2**

- Currently meets "normal" range of fuels condition expected for this plant association at normal stocking (value = 0)
- Current range of fuels "moderate" for this plant association; potential for increase in fuels from current or expected insect, disease, or other catastrophic event also moderate (value = 1)
- Current range of fuels "high" for this plant association, or expected to be high due to insect, disease, or other catastrophic events affecting stand now, or within next ten years

resulting in at least a 50% probability of a major fire event

(value = 2)

(5) Relative risk of spread of insects or diseases from infested or infected overstory stand components to susceptible developing or advanced regeneration: 0

Overstory infestation/infection non-existent or very "low;" risk of spread to understory components also "low" (value = 0)
Overstory infestation/infection and risk of spread to understory "moderate" (value = 1)
Overstory infestation/infection and risk of spread to understory "high" (value = 2)

(6) Relative risk of losing present silvicultural options in stands, based on insect and disease effects, stand structure, and composition: 2

Risk non-existent or low (value = 0)
Risk moderate (value = 1)
Risk high (value = 2)

STAND COMPOSITE SCORE 9

Forest/District: WAW/BAK
Planning Area: Baker City Watershed
Stand location: T9S, R39E, NE1/4, SW1/4 sec. 17
Brief Stand Description: Overstory is Abgr, Pico, Pipo, Psme and Laoc. Understory is mostly Abgr and is now dead. Choc and resultant Scve have killed some of the large Abgr. Psme has severe levels of Ardo and Choc damage. Light Arla in the Laoc. Extreme fuel loads were noted.

Score

(1) Relative status of Forest Plan "Desired Future Condition" for management area or resource: **2**

- Currently meets long-term (50 years) Desired Future Condition (value = 0)
- Currently meets short-term (10 years) Desired Future Condition, but will probably not meet long-term Desired Future Condition (value = 1)
- Currently meets neither short-term nor long-term Desired Future Condition, nor is expected to due to current pest trends and stand conditions (value = 2)

(2) Proportion of major stand species basal area currently defective or dead, or will be within the next 10 years: **1**

- < 25% affected (value = 0)
- 25-50% affected (value = 1)
- 51-75% affected (value = 2)
- 76-100% affected (value = 3)

(3) Current stocking conditions (include all live tree species): **2**

- Normal stocking (75-100%) (value = 0)
- Minimum or understocked (value = 1)
- Overstocked (value = 2)

(4) Relative fuels condition (size, accumulation, and structure) and potential for catastrophic stand replacement fire before the next planned management entry: **2**

- Currently meets "normal" range of fuels condition expected for this plant association at normal stocking (value = 0)
- Current range of fuels "moderate" for this plant association; potential for increase in fuels from current or expected insect, disease, or other catastrophic event also moderate (value = 1)

Current range of fuels "high" for this plant association, or expected to be high due to insect, disease, or other catastrophic events affecting stand now, or within next ten years resulting in at least a 50% probability of a major fire event

(value = 2)

(5) Relative risk of spread of insects or diseases from infested or infected overstory stand components to susceptible developing or advanced regeneration: 0

Overstory infestation/infection non-existent or very "low;" risk of spread to understory components also "low" (value = 0)
Overstory infestation/infection and risk of spread to understory "moderate" (value = 1)
Overstory infestation/infection and risk of spread to understory "high" (value = 2)

(6) Relative risk of losing present silvicultural options in stands, based on insect and disease effects, stand structure, and composition: 2

Risk non-existent or low (value = 0)
Risk moderate (value = 1)
Risk high (value = 2)

STAND COMPOSITE SCORE 9

Forest/District: WAW/BAK
Planning Area: Baker City Watershed
Stand location: T9S, R39E, NE1/4, NE1/4 sec. 20
Brief Stand Description: Overstory is Psme and Pipo. The understory is Psme. Psme is severely infected with Ardo and has had very severe levels of Choc. Abgr was noted to have damage from both Choc and Scve. Overstory Pipo is still viable.

Score

(1) Relative status of Forest Plan "Desired Future Condition" for management area or resource: 0

- Currently meets long-term (50 years) Desired Future Condition (value = 0)
- Currently meets short-term (10 years) Desired Future Condition, but will probably not meet long-term Desired Future Condition (value = 1)
- Currently meets neither short-term nor long-term Desired Future Condition, nor is expected to due to current pest trends and stand conditions (value = 2)

(2) Proportion of major stand species basal area currently defective or dead, or will be within the next 10 years: 2

- < 25% affected (value = 0)
- 25-50% affected (value = 1)
- 51-75% affected (value = 2)
- 76-100% affected (value = 3)

(3) Current stocking conditions (include all live tree species): 2

- Normal stocking (75-100%) (value = 0)
- Minimum or understocked (value = 1)
- Overstocked (value = 2)

(4) Relative fuels condition (size, accumulation, and structure) and potential for catastrophic stand replacement fire before the next planned management entry: 2

- Currently meets "normal" range of fuels condition expected for this plant association at normal stocking (value = 0)
- Current range of fuels "moderate" for this plant association; potential for increase in fuels from current or expected insect, disease, or other catastrophic event also moderate (value = 1)
- Current range of fuels "high" for this plant association, or expected to be high due to insect, disease, or other catastrophic events affecting stand now, or within next ten years resulting in at least a 50% probability of a major fire event

(value = 2)

(5) Relative risk of spread of insects or diseases from infested or infected overstory stand components to susceptible developing or advanced regeneration: 2

Overstory infestation/infection non-existent or very "low;" risk of spread to understory components also "low" (value = 0)
Overstory infestation/infection and risk of spread to understory "moderate" (value = 1)
Overstory infestation/infection and risk of spread to understory "high" (value = 2)

(6) Relative risk of losing present silvicultural options in stands, based on insect and disease effects, stand structure, and composition: 1

Risk non-existent or low (value = 0)
Risk moderate (value = 1)
Risk high (value = 2)

STAND COMPOSITE SCORE 9

Stand Classification Table:

Composite Score Range	Degree of Imminence	Comments
0-1	Low	Stands relatively healthy and expected to remain healthy for the next decade; expected to meet Desired Future Condition over this period.
2-5	Borderline Condition	Not catastrophic, but will approach catastrophic condition within five to ten years.
$\geq$ 6	Catastrophic	Presently catastrophic, or will become catastrophic within three or five years.